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90. Proposed by H. S. VANDIVER, Bala, Penn.

Prove that it is always possible to find an infinite number of positive integral values of x , y and z , such that the relation $z^2 = x^2 + bxy + cy^2$ is satisfied, b and c being any integers whatever.

** Solutions of these problems should be sent to J. M. Colaw not later than Nov. 10.

AVERAGE AND PROBABILITY

113. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy, Defiance College, Defiance, O.

A given cube is cut by a plane in such a manner that the *lines of section* form a *regular hexagon*. What is the mean area of this hexagon?

114. Proposed by LON C. WALKER, A. M., Assistant Professor of Mathematics, Leland Stanford Jr. University, Palo Alto, Cal.

If a regular polygon of n sides be placed at random on another equal polygon, show that the chance that the center of the first will fall on the second polygon is
$$\frac{\pi}{2[\pi + n \tan(\pi/n)]}$$

** Solutions of these problems should be sent to B. F. Finkel not later than Nov. 10.

MISCELLANEOUS.

114. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

When the sun's declination was 15° N. his altitude was found to be 20° , and after an hour's interval his altitude was found to be 31° . Required the latitude of the place of observation.

115. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, O.

Determine geometrically where to stand so as to be able to throw a stone over a tree with the *minimum* velocity.

116. Proposed by J. A. CALDERHEAD, B.Sc., Professor of Mathematics in Curry University, Pittsburg, Pa.

Prove that

$$- \left| \alpha_1 \beta_2 \gamma_3 \right|^2 \left| \begin{array}{ccc} a & b & c \\ b & d & e \\ c & e & f \end{array} \right|^2 = \left| \begin{array}{ccc|ccc|ccc} a & b & c & \alpha_1 & a & b & c & \alpha_1 & a & b & c & \alpha_1 \\ b & d & e & \alpha_2 & b & d & e & \alpha_2 & b & d & e & \alpha_2 \\ c & e & f & \alpha_3 & c & e & f & \alpha_3 & c & e & f & \alpha_3 \\ \alpha_1 & \alpha_2 & \alpha_3 & 0 & \beta_1 & \beta_2 & \beta_3 & 0 & \gamma_1 & \gamma_2 & \gamma_3 & 0 \end{array} \right|$$

$$\left| \begin{array}{ccc|ccc|ccc} a & b & c & \beta_1 & a & b & c & \beta_1 & a & b & c & \beta_1 \\ b & d & e & \beta_2 & b & d & e & \beta_2 & b & d & e & \beta_2 \\ c & e & f & \beta_3 & c & e & f & \beta_3 & c & e & f & \beta_3 \\ \alpha_1 & \alpha_2 & \alpha_3 & 0 & \beta_1 & \beta_2 & \beta_3 & 0 & \gamma_1 & \gamma_2 & \gamma_3 & 0 \end{array} \right|$$

$$\left| \begin{array}{ccc|ccc|ccc} a & b & c & \gamma_1 & a & b & c & \gamma_1 & a & b & c & \gamma_1 \\ b & d & e & \gamma_2 & b & d & e & \gamma_2 & b & d & e & \gamma_2 \\ c & e & f & \gamma_3 & c & e & f & \gamma_3 & c & e & f & \gamma_3 \\ \alpha_1 & \alpha_2 & \alpha_3 & 0 & \beta_1 & \beta_2 & \beta_3 & 0 & \gamma_1 & \gamma_2 & \gamma_3 & 0 \end{array} \right|$$

[From *Muir's Determinants*].

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